

AGENDA:

1. Categories, Families, Types and Instances
2. Family Libraries and Loading Families
3. Introduction to Sketching and Sketched Features

1. Categories, Families, Types, and Instances

In Revit, there are three major types of elements – Model Elements such as walls and doors, Datum elements such as levels and grids, and View specific elements such as Dimensions. Elements are classified by their Category, Family, Type, and Instance.

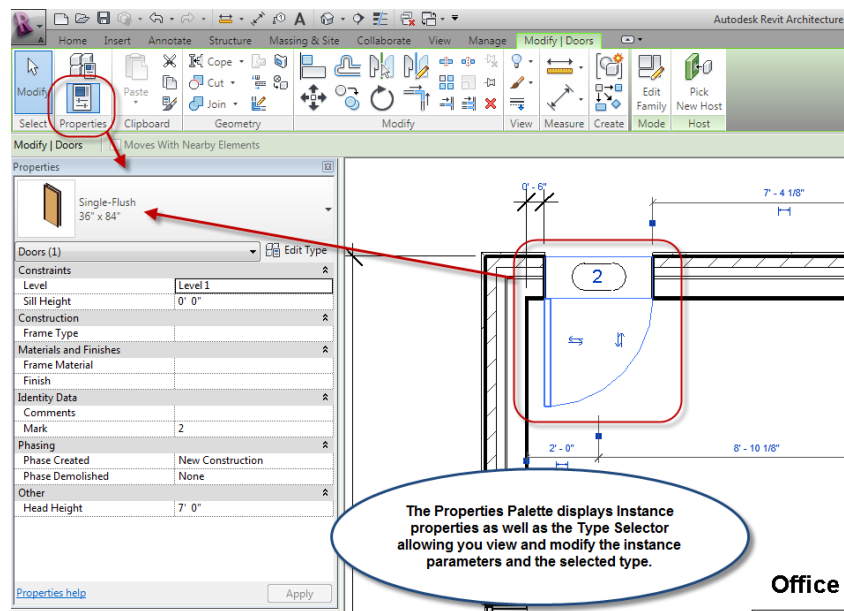
- **Category** - Categories are major classifications of elements used to design or document the building. Examples include Walls, Floors, Windows, and Room Tags.
- **Family** – Families are classes of elements in a category. Families group elements with a common set of properties, usage, or similar graphics. For example in the Door Category, you might have a Single-Flush Door family, A Bifold Door family, and a Sectional Overhead Door family.
- **Type** – Each family can have one or more types defined. A type is usually created to represent different sizes of an element. For example a double hung window family might have 3 predefined types for 24x48 inch, 30x48 inch, and 36x60 inch openings. By choosing a specific type you can quickly set two different dimensions for that element. Additional types may easily be created as required.
- **Instance** – Instances are the individual items that are placed in the project. An instance will always have a specific location within the building or on a drawing sheet depending on whether it is a model instance or an annotation instance. Individual instances may have specific parameters which can vary from one location to another.

The element properties palette allows you to view and modify the properties that define the behavior and appearance of elements in a project. The element properties content will vary with the Category of the selected element and also with the Family of the element.

All properties in a family are defined as either Type parameters or Instance parameters. When you modify a Type parameter it will automatically be applied to all instances of that type within the project. A change to a Type parameter will also affect all subsequent instances of that type that are added to the Project.

An instance parameter will affect only objects of the same type, in the current selection. Multiple objects may have their common instance parameters modified simultaneously.

The Element Properties palette allows you to view and modify the properties for an object that is being created or is currently selected. The Properties palette is displayed above the Project Browser by default but can be toggled off and on with the Properties tool from the Modify tab of the Ribbon or with the keyboard shortcut, PP.



The Element Properties palette displays the current category and the current family type within two pulldown windows at the top of the palette. The family type may be modified by choosing an available option within the Type selector. The Instance Parameters section displays all of the parameters that will be applied only to the selected instance. If you have multiple objects selected, only the instance parameters that are common to all selected objects will be displayed. Changing a value will apply to the entire selection set.

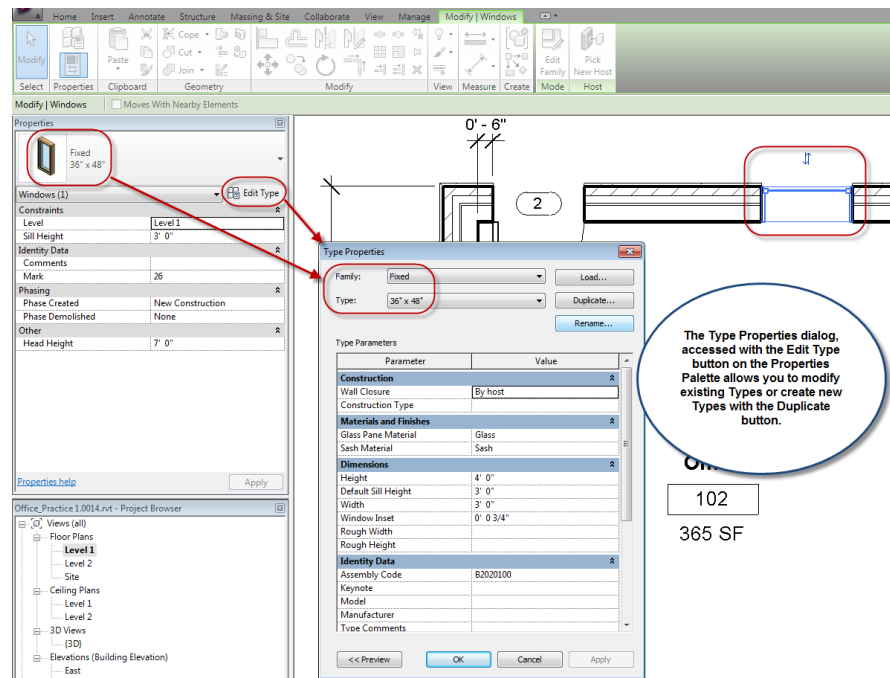
To view or modify the Type parameters, choose the Edit Type tool below the Type Selector.

The Type Properties dialog displays all of the parameters that will apply to all instances of the selected element allowing you to view and make changes to the Type. Any changes you make to a Type Parameter will affect every instance of that type in the Project.

New types may be defined by duplicating an existing type, naming the new type, and then setting the Type Parameters to be applied to all instances of the new type. This is a very useful method to use when the desired size of an element is not initially available.

To make a new Type from an existing element type without modifying any instances of the existing type, access the Element properties for the existing Type, choose Edit Type and then pick Duplicate.

Specify a new, descriptive name for the type, and modify the parameters as required. To preview the new type, select the



Preview button to open a view window where you can select a viewing direction and use a steering wheel to adjust the view. Pick Ok to apply the changes and close the Type Properties dialog.

If you do want to change the parameters for an existing type, and you want all of the existing instances of that type to be updated with the new parameters, follow the above procedure, but choose Rename instead of Duplicate. All of the existing instances will be renamed and all modified parameters will be applied.

2. Family Libraries and Loading Families

All elements in Revit Architecture belong to families. Each Family may have multiple types predefined and new types may be created by duplicating existing types. When you start a new project, the Families which are available for use will be determined by the template used to start the Project.

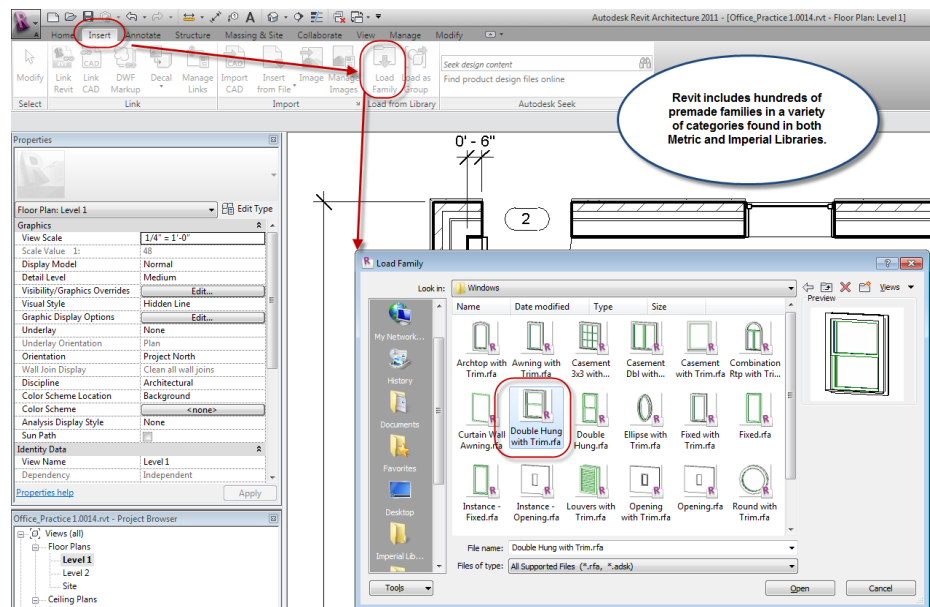
There are two general categories of Families: System Families are Host elements such as Walls, Roofs, Floors, Stairs, etc. and these system families will always be available. Variations of System families are defined by creating new Types. The other category of Families are hosted elements such as doors, windows, railings, etc and placed elements such as furniture, plumbing fixtures, annotation elements etc.

Families are defined with their own file type (.rfa) and may be created in an environment called the Family Editor. After drawing the geometry for all required views, setting up the desired parameters for the new family, and specifying the default visibility of elements for different viewing directions, the family is saved with a new name in the library of families.

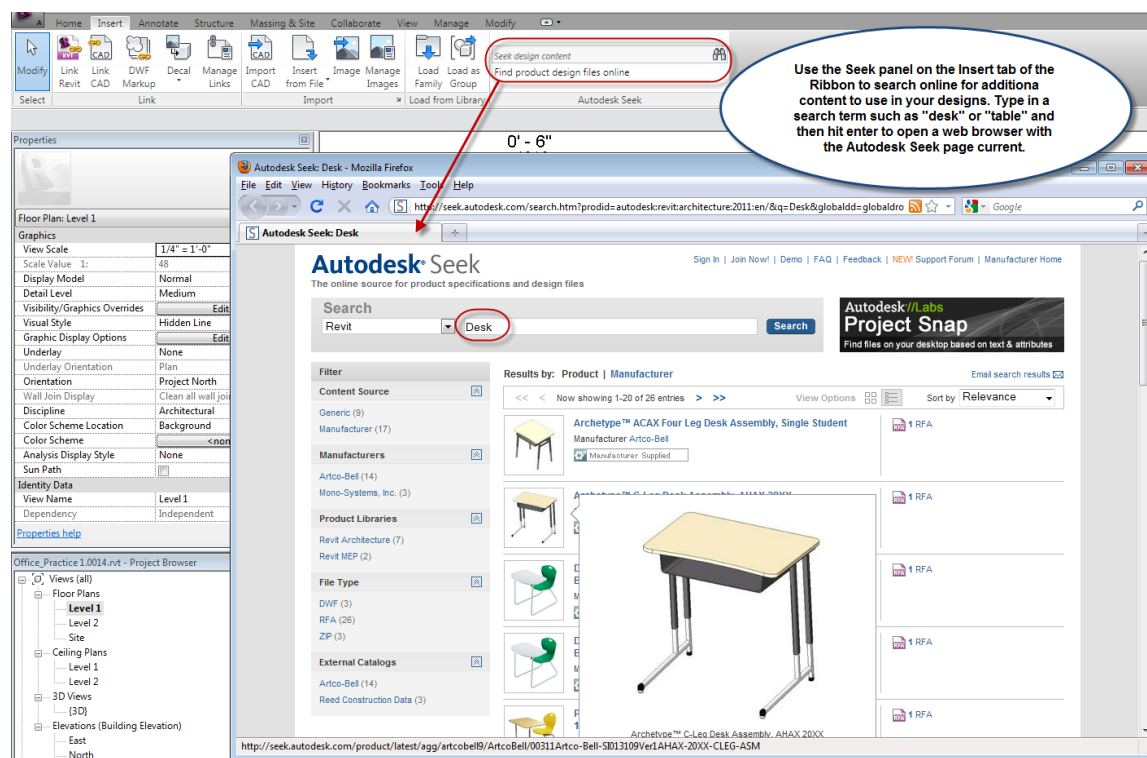
Revit Architecture provides hundreds of premade Families in over 30 different categories including Doors, Windows, Furniture, Plumbing Fixtures and many others.

These families may be loaded into a project

from the Insert tab of the Ribbon by choosing the Load from Library / Load Family selection. Multiple families may be added at a single time by pressing CTRL to add families to the selection set.



In addition to the library of Families on your computer, you can also access a wide range of families online. From the Insert tab on the Ribbon, use the Autodesk Seek panel to search for any type of Revit family content. This will open a web browser and link to the appropriate Revit content pages on the Autodesk Seek Website.

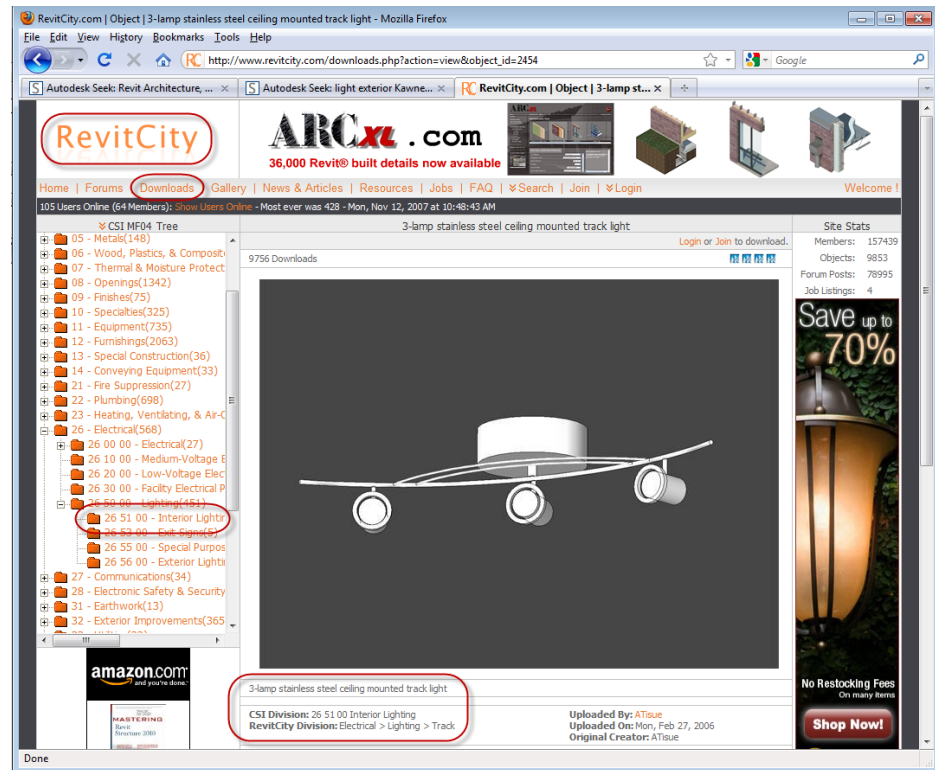


The Autodesk Seek webpage lets you perform additional searches using the Search field at the top and then filter the results with a number of different criteria such as content source and file type. View options allow you to obtain previews of the families and sometimes additional information about the family such as manufacturer or model number.

To download a family, pick the family name to open its download page. There may be several files available for different versions. Choose the desired versions and then pick the Download Selected button. This will download the family to a temporary folder, and open the file in the Family Editor. From within the Family Editor, you can choose the Load into Project tool on the Design bar or choose Saveas from the File menu to save it to a specific library folder.

More companies are creating Revit compatible content all the time. Some of these companies are listed in the Revit Manufacturer Library on the Web Content pages. More content can be found at the website, www.revitcity.com where literally thousands of families are organized into CSI categories and are available for free download after you register with the site and log in.

When you are placing elements such as doors, windows, components, annotation tags, etc. the Place Component tab on the Ribbon will display a Load Family button which may also be used to Load an existing family into the project. When you use this method, you can load a family and immediately place an instance of that family into your design.



The final method for loading a family into a project is to select an element or choose an element creation tool on the Ribbon, open the Type Properties dialog, and choose the Load button to the right of the Family name. When you load the family, it appears in the Type Properties dialog where you can set the Type, or create a new Type and then pick Ok to change the selected element or place an instance of the newly loaded family.

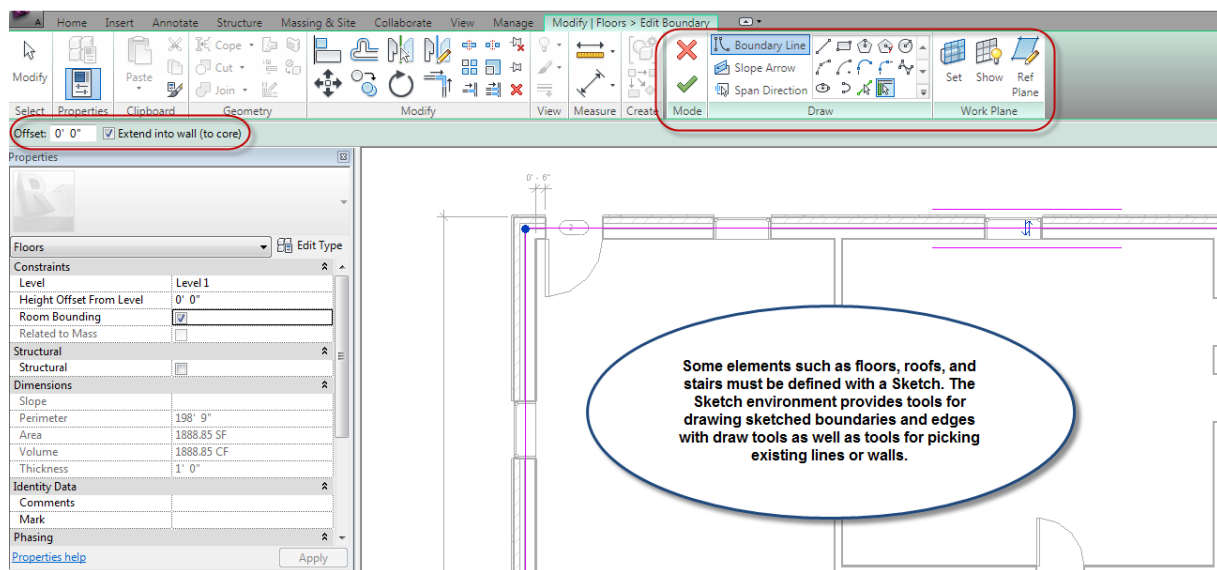
All families that have been loaded into a Project are listed in the Families category of the Project Browser. Below the family name, all types are listed. Right-clicking on the Family name in the Browser provides options to Delete or Rename the family, define a new Type for the Family, Edit the Family or Reload the family. Reloading a family optionally allows you to redefine all instances of that family which are already placed in the current project.

3. Introduction to Sketching and Sketched Features

Some elements in Revit can only be created by first sketching an outline of the object. Roofs, and Floors, require sketches. Other types of objects such as extrusions, openings, and regions also require sketches.

Sketch mode is a special environment in Revit which will open whenever you choose to create a sketch-based feature such as a floor or roof. Accessing one of these tools from the Ribbon will display a special tab called Modify | Create Boundary which displays all of the tools required to define that particular element type. For example the Create Boundary tab for a roof has tools for accessing a Slope Arrow and aligning eaves, while the Create Boundary tab for a stair will display tools for Boundary, Riser, Run and Railings type.

When you enter Sketch mode, all of the elements in the current view will appear grey and dimmed. The sketch itself will appear as pink entities which may be created by drawing them directly or by picking existing elements to trace.



Choose the Draw tools or the Pick tools on the Draw panel and specify settings such as offset, overhang, chain and radius. The offset/ overhang setting allows you to specify an overhang distance while sketching a perimeter which is very useful for both roof and floor elements.

The Pick Walls tool on the Draw panel allows you to pick a wall or set of walls and create an explicit relationship between the wall and the edge of the element being created. This means that if the wall moves, the floor, roof, stair edge, etc. will be dragged along with it, automatically updating and redrawing the linked element.

Sketches must form closed loops to create the most typical elements such as floors and roofs using the Footprint method. A loop is an end-connected series of segments with no openings, no overhangs, and no self-intersections. Use trim to create closed corners.

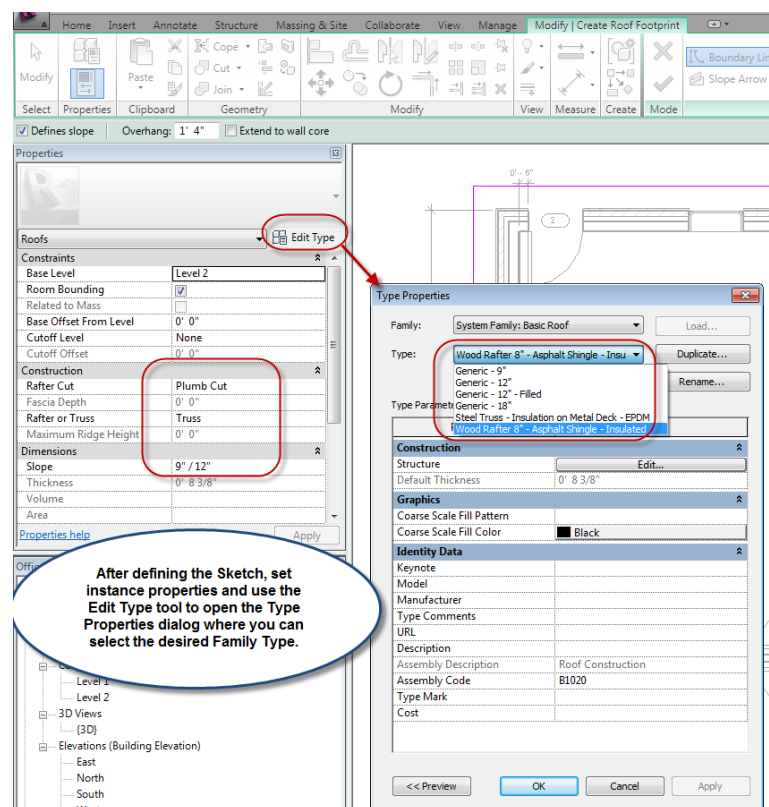
Loops inside larger loops allow you to create voids or openings, acting as internal boundaries for the sketched element. This lets you create openings in floors for stairs or openings in roofs for skylights.

Open sketches can be used to define custom stair boundaries which require two edges to define the stringers, and roof extrusions which only require a single edge.

After defining the required shape or edges for the sketched element, set the element properties such as floor type or roof type. Preset any instance parameters, pick OK, and then choose Finish Sketch to close the sketching environment and create the element.

If the element cannot be created, an error dialog will appear with a

description of the error. Choose the show button to highlight the problem area of the sketch in a different color. Choose Continue, resolve the sketch error and choose Finish Sketch again. (Repeat as required. ☺)



To modify a sketched element after it has been created, select the object and choose Edit Footprint on the Ribbon. You will then be able to edit the original sketch. Certain types of sketched elements cannot be edited in some view directions. For example a floor outline cannot be edited in an elevation view but will work in plan or 3D views. You may need to switch to a view that will support editing for the selected element type.

If you are in a perspective view and select a sketched element, the Edit button does not appear.

Sketching is not available in perspective views.

The Set tool on the work plane panel on the Sketch tab of the ribbon lets you specify the exact surface or face on which you wish to create the sketch. It is similar to the UCS command in AutoCAD. We will examine this concept in more depth when we cover modeling tools.

Sketches may include dimensions and constraints to help you define and control the shape of the sketched feature. Sketched lines and rectangles can be created with smoothly filleted corners by specifying a radius value on the Options Bar.

When you sketch a circle, you can create it with two clicks to define the centre point and the radius. After choosing the center location, you can also type the radius instead of picking a point. If you choose the Radius checkbox on the Options bar, you can preset the radius value and then add multiple circles with a single pick each to define their centres.

The Polygon is similar in operation to the Circle but also includes settings for the number of sides as well as Inscribed or Circumscribed options.

The Arc options include 3 point arcs, Centre /Start / End arcs, Tangential arcs, and Fillet Arcs which allow you to create fillets and rounds between almost any two edges. Fillet arcs automatically trim the original elements as you define the arc.

Ellipses and elliptical arcs may be defined with a minor and major radius.

Splines may be created where required to create complex curves. If it is possible to define a shape with lines and arcs instead of splines, it is recommended to do so as Splines require more processing time.

Exercise Notes

In the following exercise you will practice modifying element type and instance parameters, define new types for existing families, and load new families into your project. You will also be introduced to Sketch based features and working within the sketch environment.

1. Open the project you have been developing in the previous classes. Set Level 1 active and Zoom to Fit. At this point all of the walls should be dimensioned and all exterior openings should be dimensioned and constrained. The interior doors should be set to maintain a 4" offset from the adjacent walls.
2. Zoom in to the large Office in the upper left corner of the Plan. Move your cursor around the room and when the large X highlights indicating the Room object, pick it to select the room. In the Element Properties palette it indicates in the Selection control that the element is a Room. Check the pulldowns for Family and Type and you can see they are not available. You cannot load a different family, select a different type, or access the edit function for this type of element.
3. In the Instance Parameters section at the bottom, Review the available settings in the four groups of Parameters: Constraints, Dimensions, Identity Data, and Phasing. The dimensions section displays the exact area and perimeter but the values are grayed out as they are being calculated from the actual room size. In the Identity Data section there are numerous fields for parameters that could be linked to a Room Finish schedule. In the Name field, change Office to Meeting Room and pick Apply.
4. The Room tag associated with the Room has automatically updated with the new Element Property for the Name instance parameter. This can be set from the Tag or from the object being tagged. Pick the room tag and then pick on the name field to highlight it. Change the name to Storage Room and pick a point in the room.
5. Select the Room object again and view the Element Properties. Confirm the Identity Data, Name parameter has changed to Storage Room. Pick OK to close the dialog. Hit CTRL-Z to change the room name back to Meeting Room.

6. Switch to the Default 3D view and Zoom in around the front door area where you can see 2 or 3 of the smaller windows. Pick one of the windows, and in the Element Properties Instance Parameters section change the Sill Height to 42 inches. Pick Apply. The selected window has moved up in the wall but the other windows of the same type have not been modified since the parameter we changed was an Instance Parameter and not a Type Parameter.
7. It is possible to change instance parameters on multiple objects at one time. Pick the same window you just modified, right-click and choose Select All Instances. Look at the selection control window in the properties palette. It should show a 4 beside the Windows icon to indicate you have 4 objects in the current selection set. In the Element Properties palette, the Sill Height parameter is blank indicating that the value varies with the different elements. Set the Sill Height to 30" and pick OK. All four windows move down.
8. Zoom to fit and drag a large selection window around the entire building. Pick the Filter tool on the Selection panel of the Ribbon and choose Check None. Put a check mark beside Windows and pick Ok to close the dialog. In the Properties Palette, note the "multiple types selected" in the Type pulldown. Even though you have two types selected, both types have a sill height parameter. Set this value to 42" and pick Apply. All windows move to the new sill height.
9. Zoom in around the front door and you'll notice that the window head is now higher in the wall than the door head. Ideally they should align with each other but we don't want to cut through the sill stone between the brick and the block portions of the wall. We could edit the Wall Type and move the division between the materials lower in the wall, but we're going to work with wall types more in another class. Let's modify the Window's Type Parameter for its height and rename it appropriately.
10. Pick one of the 24" wide windows, and in the Element Properties palette, choose Edit Type. If you look in the Type Properties dialog, under Dimensions, you can see a field for Height. In the Type Properties dialog, set the Height to 42". Pick the Rename button and change the Type name to 24" x 42". Pick Ok twice to close the dialog boxes.

11. All of the 24 inch windows resize to the new parameters. Pick one of the windows and view its name in the Type Selector. Pick the Type Selector pulldown to view the available types and you'll see that the original 24" x 48" window is no longer available. Let's try it again with the 36 inch windows but retain the original type.
12. Zoom or pan until you can see a 36" window, select it and view its element properties. Pick the Edit Type button to open the Type Properties dialog and pick the Duplicate button. Set the name for the new type to 36" x 42" and pick OK. Change the Height to 42" and pick OK twice to close the dialog boxes. The selected window resized and is now displaying the new type in the Type Selector window. Zoom back a bit until you can see another of the 36" wide windows and you'll see it was not modified and is still set to the 36" x 48" type.
13. Pick one of the 36" x 48" windows, and type SA to select all instances. In the type selector, pick the new 36"x 42" to assign it to the selected windows.
14. Switch to the Level 1 plan view and zoom in to an area where you can see two instances of both types of windows. You can see that the sill element is running directly below the actual window sash which is situated almost flush with the exterior wall. We want to inset the windows about 3" from the exterior brick face. Pick one of the windows and view its element properties. Pick Edit Type and change the Window Inset value to 3.5". Pick OK to apply the changes to all windows of the selected Type. Repeat for the other size of window.
15. Zoom in to the Washroom area. From the Insert tab on the Ribbon, choose Load from Library/ Load Family. In the Load Family dialog, browse to the Imperial Library if it does not open to that folder automatically and then scroll down and double click the Plumbing /Architectural / Fixtures Water closets folder. Pick the Toilet-Domestic-3D.rfa family and pick Open to load it into the current project.
16. On the Architecture tab of the Ribbon, choose Component and pick the new toilet family component in the Type Selector. If you receive a prompt about a plumbing tag family not being available, just pick Ok to continue or if you would like, browse to the annotation tags category and load a fixture tag.

17. Press the space bar until the toilet is in the correct orientation and then pick a point to place an instance in the Washroom. Pick the toilet and adjust its temporary dimensions so the toilet is positioned 2" from the wall against which it is placed and 18" from the closest adjacent wall.
18. Pick Component and then pick Load Family. In the Load Family dialog, choose Casework and then Base Cabinets. Choose the Vanity Cabinet – Double Door Sink Unit and pick Open. In the type selector choose the 27" model. Pick a point in the upper left corner of the Washroom to place an instance of the vanity. Hit ESC twice to finish the component place command.
19. Switch to the default 3D view and modify the view angle until you can see down into the washroom and view the vanity. Hmm. No counter top and no sink, yet. This makes sense actually as it is the same way it can be built and allows you to tag and specify the cabinet, the counter, and the sink separately. Switch to Level 1 and zoom in to the washroom.
20. Choose the Load Family tool from the Insert tab, browse to the Casework / Countertops folder and choose the Vanity Counter Top w Round Sink hole. Place an instance of the counter top in the same corner as the Vanity.
21. Select the vanity countertop and try dragging the shape handles to change the length of the cabinet. Right-click and choose Element properties and then set the Length to 28" and the Sink Location to 14". Pick OK to close the dialog and apply the changes. Switch to the 3D view and you can see that the counter was placed at the correct height. If you check the Element properties for the counter, you can find the Height preset in the Type Parameters.
22. Switch back to the plan view to add a sink. Load the Sink-vanity Round family from the Plumbing Fixtures folder in the Imperial Library. Zoom in to the vanity and place the sink so it is centered over the hole in the vanity counter. Select the sink and review its element properties. Note the countertop height value in the Type Parameters. Switch back to the 3D view to confirm the correct placement of the sink.
23. Switch to the Level 1 view and zoom in around the Meeting Room in the upper left corner. If there is a desk in this office, delete it as we will be adding a conference table in this room instead.
24. Access the component tool and check the type selector for a large table. Nothing. Choose Load and browse the Furniture and Furniture Systems folders. There are domestic tables such as dining tables here but no large meeting room tables. Pick cancel.

25. It would certainly be possible to load a dining room table and then create a new type with the oversize dimensions required for our meeting room table. We could even rename the family by finding it in the Project Browser, right-clicking over the family name and using the Rename option to change Dining room to Meeting room. This would be a good practice exercise and you can try this on your own.
26. From the insert tab on the ribbon, in the Autodesk Seek panel, enter "table" and hit enter to open a browser and go to the Revit online library. Browse through the available families and towards the bottom of the list you'll see a few examples of tables which might work. In the search field Conference Table and hit enter. Under Manufacturers, choose Bernhardt. Browse the available tables and select the model called Odeon. Select the latest version and pick Download Selected. Pick the file and choose Open. (if prompted to Upgrade the file to the current version of Revit, choose Yes.)
27. A new window will appear displaying a 3D view of the table and chairs. Look at the title bar at the top and you'll notice that the file name is shown with an .rfa extension. Look at the Ribbon and you will see a new panel called Forms. This is your first look at the Family Editor environment where families are created and modified. Switch to the Ref. Level view in the Floor Plans section of the Project Browser.
28. Type VG to open the Visibility Graphic Overrides dialog. Switch to the Annotation tab and choose Show Annotation categories in this view. Pick OK. In the plan view of the table you can see a number of dimensions and a series of dashed green lines called Reference Planes which define critical locations for the elements in the Family. Try picking one of the reference planes and you will see a number of lock icons appear indicating its current constraints.
29. Pick the dimension at the top that says Table Length = 10'-0". On the Options bar, in the Label pulldown you can see the Name Table Length and beside it an empty checkbox for Instance Parameter. Dimensions with labels are one of the main means of creating the parameters that we see in the Element Properties dialog.
30. On the Properties panel of the Ribbon Home tab, choose Family Types. In the Family Types dialog, Under Family Types, Pick New. Call the new type, 96" x 48" and then pick Apply. Create a second new type called 120" x 48". Set the Table Length parameter to 10'-0". Pick Apply and then OK.

31. On the Ribbon, choose Load into Project. Choose the Current project you have been developing and pick Ok. Place an instance in the Meeting Room. Try switching the type for the table to some of the different sizes and choose the 48" x 120" to create a 10 foot table.
32. In the Level 1 view, Zoom to Fit. From the Build panel on the Ribbon, choose Floor. The existing elements will fade and the Sketch environment becomes active. On the Options Bar pick the checkmark beside Extend into wall (to core) and leave the offset at 0". Choose the Pick Walls tool and start picking the exterior walls one at a time. Note how the sketch lines are automatically trimmed or extended to clean up at the corners. Continue picking the exterior walls until you have created a closed loop. (you can also Tab select to pick up the entire chain of walls at one time)
33. In the Properties palette type selector, set the type to Wood Joist 10"-Ceramic Tile and pick OK. In the properties palette, under constraints confirm that the Level is set to Level 1 and the Height Offset from Level is set to 0". The floor thickness will be defined downward from the level and offset location. On the Ribbon, choose the green checkmark to finish the sketch and complete the floor.
34. Switch to a 3D view and type SD to shade the view. Hmm. No tile pattern. Pick the floor object and in the Type Selector try switching to the floor type with a wood finish. After choosing a new type, pick in an empty area to clear the selection so you can see the floor finish. The wood finish appears as a strip flooring pattern. Change the floor type to Steel Bar Joist 14" – VCT on Concrete and pick outside the building to view the result. The initial floor type we selected does not have a surface pattern defined for the material which is why the tiles did not appear. This can easily be modified but we'll wait for another class to try it. 😊
35. Switch back to the Level 1 view. Type SD to shade the view. Note how the desks and plumbing fixtures are hiding the tile floor. The desks and fixtures are defined with something called masking regions which will conceal objects below. Zoom in on one of the doors and you can see that the tiles are showing through the door panels instead of being hidden as you might expect.
36. Pick the door and on the model panel of the Ribbon choose Edit Family. When prompted to open Single-Flush for editing Pick Ok and the door family will be opened in the Family Editor. Switch to the Ground Floor view under Floor plans.

37. On the Annotate tab of the Ribbon, choose Masking Region and the Sketch environment will become active. From the Draw panel, choose Rectangle. Pick two corners on the door panel to trace the panel with a rectangle. Select all four lock icons to lock the sketch to the door panel edges. Pick Finish sketch and then choose the Load into Project tool. Select the main project file, pick Ok and then choose Yes in the Reload Family dialog to confirm that you will be overwriting the existing version of the door family with the newly revised one. Shade or Hide the view to see how the doors now conceal the tiles. We could easily do the same thing with table and chairs although the chair shape would require more effort.
38. Save and close your project. Backup your files as usual. We will continue in the next class with a discussion of levels and elevations and begin to layout some views on Sheets.



